

Ctenotus quirinus sp. nov. (Reptilia: Sauria: Scincidae) – a new species of skink from the Northern Territory, with the recognition of *C. brevipes* Storr, 1981 and *C. essingtonii* (Gray, 1842) as distinct species

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ABSTRACT

A new species of *Ctenotus* (Reptilia: Sauria: Scincidae), *C. quirinus* sp. nov., is described. A member of the *C. essingtonii* species complex, it is distinguished from congeners, notably *C. brevipes*, *C. burbridgei*, *C. essingtonii*, *C. hilli* and *C. gagudju*, by a combination of body pattern, mensural and meristic characteristics. The new species is terrestrial, occurring in woodland habitats on sandy soils in the far north and north-west of the Top End of Australia's Northern Territory. *Ctenotus quirinus* sp. nov. was previously confused with the polytypic taxon *C. essingtonii*, whose two described subspecies are herein recognised as distinct species and redescribed.

KEYWORDS: Reptilia, Scincidae, *Ctenotus*, new species, taxonomy, Northern Territory, Australia

INTRODUCTION

The genus *Ctenotus* Storr, 1964 is the most speciose taxon of scincid lizards in Australia. Containing about 96 known species (Wilson and Swan 2003), *Ctenotus* has been of considerable interest to taxonomists, especially over the last four decades (post-1968) when 81 taxa have been described, including a remarkable 57 from a single author (Glen Storr).

Ctenotus is distributed throughout the Australian continent, with one species occurring in southern New Guinea. *Ctenotus* species are typically diurnal and inhabit a diverse array of landforms and habitats, ranging from arid deserts to tropical savanna woodland. Many species exhibit a high degree of habitat specificity and may have very restricted distributions (Horner 1995).

Examination of specimens collected during herpetological surveys in the far north of the Northern Territory identified a series of unusually patterned *Ctenotus* from Arnhem Land and southern parts of its western escarpment. The specimens share many features with *C. essingtonii* (Gray, 1842) and would be referred to that species in most identification keys. However, comparison of the presumptive new taxon to the two described subspecies of *C. essingtonii* revealed substantial morphological divergence between all three taxa. This paper, on morphological and distributional grounds, describes the new species and recognises the two subspecies of *C. essingtonii* as distinct species. Comparisons are made between these three taxa and those species with which they could be confused and some features of their habitats are described.

METHODS

A detailed morphometric and meristic analysis was made of 39 specimens of the previously undescribed species of *Ctenotus*, 80 specimens of *C. e. essingtonii* from the Top End of the Northern Territory and 16 specimens of *C. e. brevipes* Storr, 1981 from northern Queensland. Data were recorded from preserved material and the characters quantified for each specimen are listed in Table 1. Morphometric characters were measured, under an illuminated magnifying lens, with electronic digital calipers to the nearest 0.1 mm. Unless noted otherwise, condition of bilaterally present characters was recorded from the right side. Sex was assessed through a mid-ventral incision, made in the posterior quarter of body. Primary colouration and body pattern of each specimen was also recorded. Nomenclature for scalation and body pattern follows that of Horner (1991). Definition of measurements and counts taken follow those given in Horner (1991) and Horner and Fisher (1998) with the exception of nuchal scales, which are given as a total number rather than those in one of two series.

To negate the influence of allometric growth in analyses all mensural characters were allometrically adjusted, allowing morphometric values of individuals of all taxa and at all life stages to be directly compared. Allometric conversion required raw values for morphometric characters to be converted to natural logarithms and regressed against snout-vent length using the standard allometric growth formula, $\log(y) = a \log(x) + b$, where y is the allometric dependent variable and x is the independent variable (Sokal and Rohlf 1969). In this study, morphometric character values of all specimens examined,

were adjusted to what they would be if the specimens were of mean body length by applying the formula $\bar{Y}_i = \log Y_i - b(\log X_i - \log \bar{X})$, where \bar{Y}_i is the natural logarithm of the value for the adjusted dependent variable of the *i*th specimen; Y_i is the value for the unadjusted dependent variable of the *i*th specimen; b is the pooled regression coefficient of $\log Y$ against $\log X$; X_i is the value for the independent variable of the *i*th specimen, and \bar{X} is the value for the grand mean of the independent variable (Thorpe 1975; Shea 1995). The resulting logarithm value of the dependent variable was transformed to its adjusted value by calculation of the antilog. Allometrically adjusted values were used in statistical analyses only, raw values were used in taxon descriptions.

The mean, standard deviation, range and mode (when available) of each variable were calculated for each taxon (Table 1). The following comparisons between taxa were made for each variable using Mann-Whitney U-tests, or χ^2 tests for frequency data: (1) between male and female specimens of the new species and those of *C. e. essingtonii* (*C. e. brevipes* lacked sufficient sample sizes); (2) between all specimens of the new species and *C. e. essingtonii* and *C. e. brevipes*. Analyses of geographic variation were based on linear regressions of characters against both latitude and longitude. Statistically significant relationships were assessed from scatterplots of each variable. For these analyses, latitude and longitude were entered as decimal fractions of degrees. Where characters were affected by sexual dimorphism, sexes were analysed separately. Tests were carried out with the statistical program STATISTICA (Statsoft Inc. 1997).

The following abbreviations are used in the text: AM, Australian Museum, Sydney, Australia; ANWC, Australian National Wildlife Collection, Canberra, Australia; BMNH, Natural History Museum, London, England; NTM, Museum and Art Gallery of the Northern Territory, Darwin, Australia; QM, Queensland Museum, Brisbane, Australia.

RESULTS

Lateral markings, particularly the absence and or degree of upper lateral zone patterning, identified three morpho-groups. These groups were further differentiated by combinations of mensural and meristic characters (see comparisons with similar species) which, in combination, supported specific differentiation and recognition of each group as discrete species. Meristic and mensural characters for specimens of the new *Ctenotus* species and comparative *C. e. essingtonii* and *C. e. brevipes* are summarised in Table 1.

Tests for sexual dimorphism indicated that males of both the new species and *C. e. essingtonii* differ from females by having a shorter body, fewer paravertebral scales, longer forebody and longer, deeper head (Table 2). In all comparative analyses these sexually dimorphic

variables were either omitted or, where sample sizes were sufficient, tested separately.

SYSTEMATICS

Employing the generic diagnoses provided by Storr (1964) and Cogger (2000), taxa examined were assigned to the scincid genus *Ctenotus* Storr, 1964 on the following external characters: parietal scales in contact behind interparietal; lower eyelids moveable and scaly; limbs pentadactyl; supranasal scales absent; nasal scale undivided; body scales smooth; lower secondary temporal scales overlapping upper temporal scale; colour pattern containing dorsal and lateral longitudinal stripes; and anterior ear lobules usually present.

To aid identification of *Ctenotus* in Western Australia, Storr distributed the species from that region among ten species groups (Storr 1981; Storr *et al.* 1999). Based on morphological similarity, these species groups are not necessarily natural but are functional in clustering similar species together. Wilson and Knowles (1988) recognised twelve species groups incorporating all *Ctenotus* species. The following eight character states in combination place the previously undescribed species, *C. e. essingtonii* and *C. e. brevipes* in the *C. essingtonii* species group of Storr (Storr 1981; Storr *et al.* 1999): medium size; slender body; digits compressed; subdigital lamellae smooth or bearing moderately broad, dark calli; second supraocular usually wider than first and much wider than third; ear lobules absent, small or very disparate in size; dark vertebral stripe narrow or absent; dark upper lateral zone with or without a series of pale spots.

Wilson and Knowles (1988) list four taxa as members of the *C. essingtonii* species group: *C. burbridgei* Storr, 1975; *C. e. essingtonii* (Gray, 1842); *C. e. brevipes* Storr, 1981; *C. hilli* Storr, 1970. Storr *et al.* (1999) suggest the content of the species group to be five species from far northern Australia. Here their additional taxon is presumed to be *C. gagdju* Sadlier, Wombey and Braithwaite, 1985, which Sadlier *et al.* (1985) aligned with *C. hilli*.

Ctenotus Storr, 1964 *Ctenotus brevipes* Storr, 1981 (Figs 1, 2; Table 1)

Material examined. HOLOTYPE – QMJ39469 (formerly AM R63611), unsexed, Blackbull, Queensland, Australia, 17°48'S, 141°44'E, 3 July 1977, collected by A. and P. Greer (see Shea and Sadlier 1999, for type locality correction). PARATYPES (4 specimens) – QUEENSLAND: AMR63334, Croydon, 18°12'S, 142°15'E; AMR26904, Hann River, Kennedy Road, 15°11'S, 143°51'E; AMR63610, Blackbull, 17°48'S, 141°44'E; AMR70939, Muldiva, 17°21'S, 144°35'E.

Other material (12 specimens). QUEENSLAND: AMR113775, 18.6 km south of Lappa Railway Station, 17°31'S, 144°55'E; AMR113808, 10.5 km north of

Chillagoe, 17°03'S, 144°31'E; ANWC1601, Lynd River, Bolwarra Station, 17°30'S, 143°58'E; ANWC1602, Lynd River, Bolwarra Station, 17°30'S, 143°58'E; ANWC1605, Lynd River, Bolwarra Station, 17°30'S, 143°58'E; QMJ23488, Coen, 13°57'S, 143°12'E; QMJ38012, 18 km north of Glen Garland Station, 14°54'S, 143°14'E; QMJ38013, 18 km north of Glen Garland Station, 14°54'S, 143°14'E; QMJ38014, 18 km north of Glen Garland Station, 14°54'S, 143°14'E; QMJ47526, Esmeralda Creek, Esmeralda Station, 18°46'S, 142°36'E; QMJ51741, Galbraith Outstation, 16°24'S, 141°32'E; QMJ58184, Shelfer Crossing, Mitchell River, 15°23'S, 141°58'E.

Diagnosis. A moderately small *Ctenotus* (SVL to 60 mm) distinguished from congeners by having three of four supraoculars in contact with frontal, two presuboculars, frontoparietals paired, laterally compressed toes with smooth or callose subdigital lamellae, prominent pale mid-lateral stripe, broad dorsal zone of ground colour, vertebral stripe absent or confined to nape, dark laterodorsal stripe obscure or absent, 24 midbody scale rows, lateral pattern of longitudinal stripes, dark upper lateral zone usually unspotted.

Description. Prefrontal scales broadly separated (100%). Nasal scales usually narrowly separated by rostral and frontonasal scales (81%), occasionally in narrow contact (19%). Frontoparietal scales paired. Interparietal scale distinct. Loreal scales two, second usually larger than first. Upper and lower preocular scales present. Presubocular scale present (100%). Nuchal scales 4–10 (mean = 7.2, sd = 1.39), modally 8. Supraciliary scales 8–10 (mean = 8.9, sd = 0.61), modally 9, median four or five much smaller than first three and final scale in series. Ciliary scales 7–10 (mean = 8.9, sd = 0.80), modally 9. Supralabial scales 7–8 (mean = 7.0, sd = 0.25), modally 7, fifth usually under orbit (94%). Infralabial scales 6–7 (mean = 6.4, sd = 0.51), modally 6. Ear lobules absent (Table 1).

Midbody scale rows 22–25 (mean = 23.8, sd = 0.75), modally 24. Paravertebral scales 54–66 (mean = 59.4, sd = 3.26), modally 62. Subdigital lamellae smooth (71%) or narrowly callose (29%), 11–15 below fourth finger (mean = 12.8, sd = 1.04) modally 13, 17–23 below fourth toe (mean = 19.9, sd = 1.57) modally 20. Supradigital scales above fourth finger 9–11 (mean = 10.0, sd = 0.63) modally 10, above fourth toe 16–19 (mean = 17.1, sd = 0.80) modally 17 (Table 1).

Snout-vent length to 60 mm (mean = 48.0 mm, sd = 4.62). Percentages of snout-vent length: body length 49.8–58.7% (mean = 54.8%, sd = 2.29); tail length 187.0–228.6% (mean = 203.7%, sd = 14.49, n = 10); forelimb length 22.3–29.9% (mean = 25.6%, sd = 2.23); hindlimb length 37.2–47.5% (mean = 41.9%, sd = 2.71); forebody length 30.7–40.2% (mean = 35.5%, sd = 2.11); head length 17.1–22.9% (mean = 19.4%, sd = 1.28). Percentages of head length: head depth 44.0–57.1% (mean = 51.3%, sd = 4.20); head width 53.2–65.5% (mean = 60.2%, sd = 3.24); snout length 44.1–53.2% (mean = 46.6%, sd = 2.13) (Table 1).

Colour and pattern (in spirit). A brownish *Ctenotus* with longitudinally aligned, simple body pattern dominated by immaculate, broad dorsal zone of ground colour and dark and pale lateral stripes (Fig. 1). Most specimens conform to the following description.

Dorsal surface a broad zone of rich brown-grey, often patterned with a narrow, obscure, blackish brown vertebral stripe on nape and/or forebody, occasionally this extends to the hindquarters as a discontinuous dark vertebral stripe. Outer margins of dorsal zone bordered by prominent to obscure, blackish brown laterodorsal stripes, about half as wide as underlying laterodorsal scales, which variably extend from above eye to region of hindlimb, although are usually most prominent anteriorly. Outer margins of laterodorsal stripes bordered by prominent white dorsolateral stripes, about half as wide as underlying dorsolateral scales, which extend from outer edge of supraocular scales onto tail.

Lateral surface of body patterned with immaculate broad brown-black upper lateral zone extending from loreal region to hindlimb. Broad white mid-lateral stripe, about two thirds as wide as upper lateral zone, extends from supralabials, above forelimbs to hindlimb. Brown-grey lower lateral zone, about half as wide as upper lateral zone, extends from below auricular opening to hindlimb.

Head and tail concolorous with body, although dorsal surface of head is often patterned with obscure dark reticulations. Limbs light brown on dorsal surface, patterned with three or four obscure dark brown stripes. Ventral surface of body immaculate white, underside of chin, limbs and tail creamish.

A specimen in life is illustrated by Wilson and Swan (2003: 163) as *C. e. brevipes*.

Sexual dimorphism. Sex ratio of specimens examined favoured males (12:4) and was significantly different from parity ($X^2 = 4.55$). Small sample size of females prevented analysis of sexual dimorphism.

Details of holotype. QM J39469. Snout-vent length 49.3 mm; tail length 97.0 mm; body length 29.8 mm; forelimb length 12.0 mm; hindlimb length 19.8 mm; head

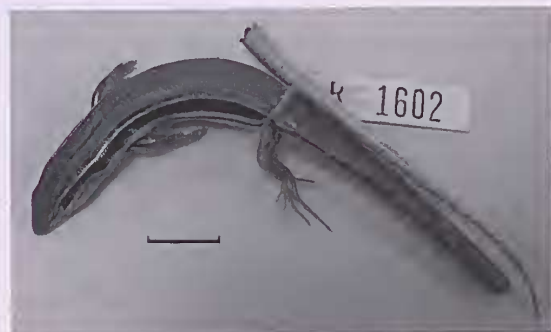


Fig. 1. *Ctenotus brevipes*. Preserved specimen ANWC1602, from Lynd River, Bolwarra Station, north-east Queensland, 17°30'S, 143°58'E.

Table 1. Summary of mensural and meristic variables for *Ctenotus quirinus* sp. nov., *C. essingtonii* and *C. brevipes*. Presented are mean (\pm 1 SD), mode (meristics only) and range in parentheses. Probability associated with ANOVA between *C. quirinus* sp. nov. and *C. essingtonii*, and *C. quirinus* sp. nov. and *C. brevipes* is given for each variable. 'ns' indicates $P > 0.05$.

Character	<i>C. quirinus</i> sp. nov (n=39)	<i>C. essingtonii</i> (n=80)	prob. (p)	<i>C. brevipes</i> (n=16)	prob. (p)
midbody scale rows	27.0 \pm 1.07, 28 (25-28)	26.4 \pm 1.25, 26 (24-30)	0.020	23.8 \pm 0.75, 24 (22-25)	0.001
paravertebral scales	66.9 \pm 5.37, 68 (56-80)	65.2 \pm 3.67, 65 (57-76)	0.045	59.4 \pm 3.26, 62 (54-66)	0.001
nuchal scales	6.7 \pm 0.89, 7 (4-8)	7.3 \pm 1.32, 8 (4-12)	0.004	7.2 \pm 1.39, 8 (4-10)	ns
supralabial scales	7.1 \pm 0.39, 7 (7-8)	7.0 \pm 0.28, 7 (7-8)	ns	7.0 \pm 0.25, 7 (7-8)	ns
infralabial scales	6.9 \pm 0.35, 7 (6-8)	7.0 \pm 0.53, 7 (6-8)	ns	6.4 \pm 0.51, 6 (6-7)	0.006
supraciliary scales	9.0 \pm 0.53, 9 (8-10)	9.2 \pm 0.53, 9 (8-11)	ns	8.9 \pm 0.61, 9 (8-10)	ns
ciliary scales	9.8 \pm 0.78, 10 (9-12)	10.1 \pm 0.72, 10 (9-12)	0.010	8.9 \pm 0.80, 9 (7-10)	0.001
ear lobules	3.0 \pm 0.40, 3 (2-4)	2.8 \pm 0.68, 3 (2-4)	ns	0 \pm 0.00, 0 (0)	0.001
subdigital lamellae (4 th finger)	12.3 \pm 0.81, 12 (11-14)	12.2 \pm 0.94, 12 (9-15)	ns	12.8 \pm 1.04, 13 (11-15)	ns
supradigital lamellae (4 th finger)	10.0 \pm 0.84, 10 (9-12)	9.7 \pm 0.83, 10 (8-13)	ns	10.0 \pm 0.63, 10 (9-11)	ns
subdigital lamellae (4 th toe)	22.7 \pm 1.46, 23 (20-27)	23.4 \pm 1.51, 23 (20-27)	0.018	19.9 \pm 1.57, 20 (17-23)	0.001
supradigital lamellae (4 th toe)	18.9 \pm 1.36, 19 (16-22)	19.4 \pm 1.47, 19 (15-23)	ns	17.1 \pm 0.80, 17 (16-19)	0.001
snout-vent length (mm)	53.1 \pm 4.83 (44.7-64.9)	53.1 \pm 5.36 (37.7-65.2)	ns	48.0 \pm 4.62 (41.1-60.0)	0.001
body length (%svl)	57.3 \pm 2.58 (51.4-62.0)	57.1 \pm 2.67 (51.2-63.5)	ns	54.8 \pm 2.29 (49.8-58.7)	ns
tail length (%svl)	213.3 \pm 16.55 (170.8-239.4) (n=17)	225.8 \pm 6.90 (179.0-250.4) (n=43)	0.026	203.7 \pm 14.49 (187.0-228.6) (n=10)	ns
forelimb length (%svl)	24.7 \pm 1.47 (21.5-27.6)	25.1 \pm 1.77 (20.8-29.0)	ns	25.6 \pm 2.23 (22.3-29.9)	ns
hindlimb length (%svl)	42.5 \pm 2.94 (35.6-48.2)	44.2 \pm 3.02 (38.0-52.0)	0.001	41.9 \pm 2.71 (37.2-47.5)	0.001
forebody length (%svl)	34.1 \pm 1.82 (30.1-37.4)	34.2 \pm 2.09 (29.8-38.6)	ns	35.5 \pm 2.11 (30.7-40.2)	ns
head length (%svl)	19.2 \pm 1.02 (17.6-21.2)	19.7 \pm 0.90 (17.5-21.6)	0.004	19.4 \pm 1.28 (17.1-22.9)	0.026
head depth (%hl)	51.9 \pm 3.66 (44.1-61.9)	51.9 \pm 2.79 (45.0-59.3)	ns	51.3 \pm 4.20 (44.0-57.1)	ns
head width (%hl)	58.4 \pm 3.18 (50.6-66.3)	59.0 \pm 2.90 (54.2-65.8)	0.013	60.2 \pm 3.24 (53.2-65.5)	ns
snout length (%hl)	44.7 \pm 4.01 (24.4-50.6)	43.0 \pm 2.19 (39.0-51.3)	0.012	46.6 \pm 2.13 (44.1-53.2)	ns
supraocular (largest)	second 87% subequal 13%	second 100%	ns	second 100%	ns
prefrontal (contact point)	contact 3% separated 97%	contact 4% separated 96%	ns	contact 100%	ns
nasal (contact point)	contact 26% separated 74%	contact 9% separated 91%	ns	narrow contact 19% narrow separation 81%	ns
presubocular (presence)	present 92% absent 8%	present 100%	ns	present 100%	ns
subocular (supralabial)	5 th labial 82% 6 th labial 18%	5 th labial 91% 6 th labial 9%	ns	5 th labial 94% 6 th labial 6%	ns
ear lobule (largest)	upper 79% mid 21%	upper 90% mid 10%	ns	absent 100%	0.001
subdigital lamellae (condition)	smooth 23% callose 77%	smooth 16% callose 84%	ns	smooth 71% callose 29%	0.007

width 5.6 mm; head depth 5.2 mm; snout length 4.0 mm; head length 8.6 mm; forelimb to snout length 15.8 mm; nasals narrowly separated; prefrontals broadly separated; supraciliaries nine; ciliaries eight; supralabials seven; infralabials six; nuchal scales seven; ear lobules absent; subdigital lamellae under fourth finger 12, under fourth toe

19; supradigital scales above fourth finger 10, above fourth toe 16; midbody scale rows 25; paravertebral scales 60.

Comparison with similar species. Among congeners, *C. brevipes* is most similar to other members of the *C. essingtonii* species group (*C. burbridgei*, *C. essingtonii*, *C. gagudju*, *C. hilli* and *C. quirinus* sp. nov.) in having

combinations of broad dorsal zone of ground colour, vertebral stripe absent or confined to nape, prominent pale mid-lateral stripe and moderately callose subdigital lamellae. However it may be distinguished from these by having fewer mid-body scales rows (mode of 24 instead of 26 or more), fewer infralabial scales (mode of six instead of seven) and by lacking anterior ear lobules. Further, it differs from *C. burbridgei*, *C. gagudju*, *C. hilli* and *C. quirinus* sp. nov. by having an unpatterned, instead of spotted or blotched, upper lateral zone.

Ctenotus brevipes is most easily confused with *C. essingtonii* but is further distinguished from that taxon by being smaller (mean SVL 48.0 instead of 53.1 mm, $p = 0.001$), having less fourth toe subdigital lamellae (mode 20 instead of 23, $p = 0.001$), a shorter head (mean: males 10.0 instead of 10.5 mm, $p = 0.001$; females 9.6 instead of 10.0 mm, $p = 0.001$) and fewer paravertebral scales (mean: males 58.4 instead of 64.2, $p = 0.001$; females 62.5 instead of 66.7, $p = 0.020$).

Distribution. The known distribution of *C. brevipes* is far northern Queensland (Fig. 2), principally from mid- and lower Cape York Peninsula. Storr (1981) records the species from Rifle Creek, 28 kilometres south of Mount Isa. Within this distribution *C. brevipes* occurs in the following bioregions (Environment Australia 2000): Cape York Peninsula (CYP), Einasleigh Uplands (EIU), Gulf Plains (GUP) and Mount Isa Inlier (MII).

Geographic variation. No significant pattern of latitudinal or longitudinal variation was identified.

Ecology and habitats. Poorly known. Wilson and Swan (2003) record *C. brevipes* as associated with low vegetation in semi-arid to subhumid woodlands. Australian Museum records note its collection from a rubbish dump and under tin.

Nomenclatural history. *Ctenotus essingtonii brevipes* was described from the holotype and 14 paratypes by

Storr (1981). Its recognition as a discrete species agrees with Wells and Wellington (1985), who controversially elevated it from subspecies to species without diagnosis or taxonomic comment. Wilson and Swan (2003) also suggested that *C. e. brevipes* warranted recognition as a separate species. Published works have previously referred material of this species to *C. essingtonii brevipes* (Cogger 2000; Cogger *et al.* 1983; Ehmann 1992; Horner 1991; Wilson and Knowles 1988; Wilson and Swan 2003).

Etymology. *Brevipes* is derived from the Latin for 'short-footed' (Storr 1981).

Ctenotus essingtonii (Gray, 1842)

(Figs 2–4; Tables 1, 2)

Material examined. HOLOTYPE – BMNH 1937.12.6.11, Port Essington, Cobourg Peninsula, Northern Territory, Australia.

Other material (81 specimens): NORTHERN TERRITORY (NTM material): R128, Milncr, Darwin, 12°24'S, 130°52'E; R3861, Mt Broekman, Kakadu Nat. Pk, 12°45'S, 132°56'E; R4025-026, Jim Jim Falls, Kakadu Nat. Pk, 13°17'S, 132°50'E; R4593, Berry Springs, 12°42'S, 130°58'E; R6899, Howard Swamps, 12°26'S, 131°04'E; R7624, Jabiluka Project Area, Kakadu Nat. Pk, 12°29'S, 132°55'E; R7626, Poached Egg Rock Area, Jabiluka Area, Kakadu Nat. Pk, 12°29'S, 132°55'E; R7627, R7629, R7631, Jabiluka Project Area, Kakadu Nat. Pk, 12°29'S, 132°55'E; R7673-675, Cape Hotham, 12°03'S, 131°17'E; R7885, R7984, R7987, Cape Foureroy, Bathurst Island, 11°47'S, 130°01'E; R8385, Leanyer, Darwin, 12°22'S, 130°55'E; R8667, Florence Falls, Litchfield Nat. Pk, 13°09'S, 130°38'E; R8761, Bamboo Creek, Litchfield Nat. Pk, 13°09'S, 130°38'E; R10958, Tolmer Falls, Litchfield Nat. Pk, 13°12'S, 130°42'E; R12598-599, Jabiru, Kakadu Nat. Pk, 12°40'S, 132°53'E; R13583, R13591, R13600, Talbot Road, Murguella, 11°34'S, 132°52'E; R13716-721,

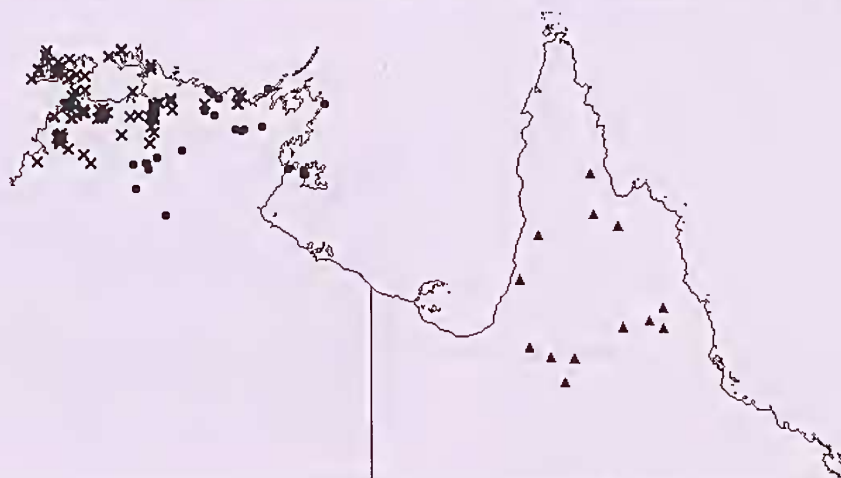


Fig. 2. Map of north-eastern Australia showing known distributions of *Ctenotus quirinus* sp. nov., *C. essingtonii* and *C. brevipes*. Legend: crosses = *C. essingtonii*; circles = *C. quirinus* sp. nov.; triangles = *C. brevipes*.

R13750, Swim Creek, Point Stuart Station, 12°34.5'S, 131°49.5'E; R16183, Liverpool River Crossing, Arnhem Land, 12°22'S, 134°07'E; R16537, 20 km S Nabarlek Mine, 12°30'S, 133°21'E; R17748, Kapalga, Kakadu Nat. Pk, 12°40'S, 132°22'E; R17819, Territory Wildlife Park, Berry Springs, 12°43'S, 130°59'E; R20707, R20709, R20743, Kakadu National Park (Stage Three), 13°05'S, 132°09'E; R20829, R20834-835, Murgarella, 11°28'S, 132°51'E; R20956, Black Point, Cobourg Peninsula, 11°09'S, 132°10'E; R20999, Ramingining Area, Arnhem Land, 12°22'S, 134°54'E; R21036-040, Smith Point Airstrip, Cobourg Peninsula, 11°08'S, 132°10'E; R21102, Wildman River Cashew Plantation, 12°42'S, 131°36'E; R21203, Milikapiti, Melville Island, 11°25'S, 130°40'E; R22188, R22233, Litchfield National Park, 13°24.49'S, 130°53.50'E; R22856, Taraeumbie Falls, Melville Island, 11°36.33'S, 130°42.31'E; R23901, R23910, R23912, R23916, Djapididjapin Creek, nr Ramingining, Arafura Swamp, 12°22.11'S, 134°55.04'E; R23956-958, R23961, R23966, R23979, Ramingining Area, Arafura Swamp, 12°12.34'S, 134°58.87'E; R24089, Wildman River Reserve, 12°39'S, 131°43'E; R24356, Douglas River, 13°45'S, 131°25'E; R25020, Douglas Station, Daly River Region, 13°31.73'S, 131°15.59'E; R25117-118, Marrakai Station, Mary River System, 12°31.22'S, 131°37.52'E; R26159, La Belle Station, Daly River, 13°42.73'S, 130°08.96'E; R26183, Radford Point, Melville Island, 11°20.11'S, 130°55.63'E; R26192, Melville Island, 11°40.99'S, 131°06.37'E; R26203, Melville Island, 11°38.37'S, 130°37.91'E; R26244, 11 km NNW of Piekertaramoor, Melville Island, 11°41.52'S, 130°50.00'E; R26351, Gunn Point, Outer Darwin, 12°14.03'S, 131°01.50'E; R26408, Lambells Lagoon, Outer Darwin, 12°34.93'S, 131°14.39'E; R28803, Maeallums Creek, Litchfield Nat. Pk, 13°05'S, 130°40'E; R28870-871, Jabiluka, Kakadu Nat. Pk, 12°32'S, 132°55'E; R31901, Deaf Adder Creek, Kakadu Nat. Pk, 13°02'S, 132°56'E.

Diagnosis. A moderately small *Ctenotus* (SVL to 65 mm) distinguished from congeners by having three of four supraoculars in contact with frontal, two presuboculars, frontoparietals paired, laterally compressed toes with callose or smooth subdigital lamellae, prominent pale mid-lateral stripe, broad dorsal zone of ground colour, vertebral stripe absent or confined to nape, dark laterodorsal stripe obscure or absent, 26 midbody scale rows, lateral pattern of longitudinal zones or stripes, dark upper lateral zone spotted or unspotted.

Description. Prefrontal scales usually broadly (56%) or narrowly separated (40%), occasionally in narrow contact (4%). Nasal scales usually broadly (42%), or narrowly separated (50%) by rostral and frontonasal scales, occasionally in narrow (7%) or broad (1%) contact. Frontoparietal scales paired. Interparietal scale distinct. Loreal scales two, second usually larger than first. Upper and lower preocular scales present. Presubocular scale present (100%). Nuchal scales 4–12 (mean = 7.3, sd = 1.32), modally 8. Supraciliary scales 8–11 (mean = 9.2, sd

= 0.53) modally 9, median four or five much smaller than first three and final scale in series. Ciliary scales 9–12 (mean = 10.1, sd = 0.72), modally 10. Supralabial scales 7–8 (mean = 7.0, sd = 0.28) modally 7, fifth usually under orbit (91%), occasionally sixth (9%). Infralabial scales 6–8 (mean = 7.0, sd = 0.53), modally 7. Ear lobules 2–4 (mean = 2.8, sd = 0.68) modally 3, uppermost usually largest (90%), occasionally mid-lobule largest (10%) (Table 1).

Midbody scale rows 24–30 (mean = 26.4, sd = 1.25), modally 26. Paravertebral scales 57–76 (mean = 65.2, sd = 3.67), modally 65. Subdigital lamellae usually moderately callose (84%) or occasionally smooth (16%), 9–15 below fourth finger (mean = 12.2, sd = 0.94) modally 12, 20–27 below fourth toe (mean = 23.4, sd = 1.51) modally 23. Supradigital scales above fourth finger 8–13 (mean = 9.7, sd = 0.83) modally 10, above fourth toe 15–23 (mean = 19.4, sd = 1.47) modally 19 (Table 1).

Snout-vent length to 65.2 mm (mean = 53.1 mm, sd = 5.36). *Percentages of snout-vent length:* body length 51.2–63.5% (mean = 57.1%, sd = 2.67); tail length 179.0–250.4% (mean = 225.8%, sd = 6.90); forelimb length 20.8–29.0% (mean = 25.1%, sd = 1.77); hindlimb length 38.0–52.0% (mean = 44.2%, sd = 3.02); forebody length 29.8–38.6% (mean = 34.2%, sd = 2.09); head length 17.5–21.6% (mean = 19.7%, sd = 0.90). *Percentages of head length:* head depth 45.0–59.3% (mean = 51.9%, sd = 2.79); head width 54.2–65.8% (mean = 59.0%, sd = 2.90); snout length 39.0–51.3% (mean = 43.0%, sd = 2.19) (Table 1).

Colour and pattern (in spirit). A brownish *Ctenotus* with longitudinally aligned, simple or complex body pattern dominated by immaculate, broad dorsal zone of ground colour. Lateral pattern variable, covering a spectrum between two principal forms: (1) a simple unspotted arrangement of smooth-edged, longitudinal zones and stripes (Fig. 3); (2) a more complex pattern with prominent lateral spotting (Fig. 4). Most specimens conform to the following description.

Dorsal ground colour brown to brown-grey. Immaculate, broad dorsal zone extends from head onto tail. Vertebral stripe usually absent, although occasional specimens have an obscure blackish brown stripe on nape and forebody. Outer margins of dorsal zone bordered by prominent to obscure, blackish brown laterodorsal stripes, about half as wide as underlying laterodorsal scales, which variably extend from above eye to region of hindlimb, although are usually most prominent anteriorly. Outer margins of laterodorsal stripes bordered by prominent white dorsolateral stripes, about half as wide as underlying dorsolateral scales, which extend from outer edge of supraocular scales onto tail. In simply patterned specimens lateral surfaces are patterned with immaculate broad black-brown upper lateral zone, extending from loreal region to hindlimb. Occasionally this dark upper lateral zone may be patterned with three or four pale spots between the eye and forelimb. Prominent to obscure narrow white mid-lateral stripe, about one third as wide

as upper lateral zone, extends from supralabials, above forelimbs to hindlimb. Mottled pale brown lower lateral zone, about half as wide as upper lateral zone, extends from below auricular opening to hindlimb. Complexly patterned specimens share the above lateral arrangement, however the dark upper lateral zone is patterned with obscure to prominent, single longitudinal series of regularly spaced pale spots. Lower lateral zone coalesces into pale venter.

Head and tail concolorous with body. Limbs light brown dorsally, patterned with dark brown mottling and/or obscure dark brown streaks. Ventral surfaces immaculate white, underside of chin, limbs and tail creamish.

Sexual dimorphism. Sex ratio of specimens examined favoured males (47:33) but was not significantly different from parity ($X^2 = 2.40$). Analysis of allometrically adjusted values detected significant sexual dimorphism in body, forebody and head lengths, head depth and number of paravertebral scales. Table 2 shows that females have a longer body and more paravertebral scales, but a shallower head and shorter forebody and head in comparison to males (means: body = 30.6 versus 29.4 mm, $p = 0.001$; paravertebral scales = 66.7 versus 64.2, $p = 0.002$; head depth = 5.1 versus 5.5 mm, $p = 0.001$; forebody length = 18.3 versus 17.5 mm, $p = 0.001$; head length = 10.0 versus 10.5 mm, $p = 0.001$).

Details of holotype. BMNH 1937.12.6.11. Snout-vent length 38.5 mm; tail length 76.1 mm; body length 19.6 mm; forelimb length 10.3 mm; hindlimb length 18.0 mm; head width 4.5 mm; head depth 6.6 mm; snout length 3.2 mm; head length 7.8 mm; forelimb to snout length 14.5 mm; nasals broadly separated; prefrontals broadly separated; supraciliaries nine; ciliaries nine; supralabials seven; infralabials six; nuchal scales seven; ear lobules three; subdigital lamellae under fourth toe 22; midbody scale rows 25; paravertebral scales 65.

Although difficult to distinguish, the body pattern of the holotype conforms to the complex form with prominent lateral spotting.

Comparison with similar species. Among congeners, *C. essingtonii* is most similar to other members of the



Fig. 3. *Ctenotus essingtonii* (simply patterned form) in life. Swim Creek, Point Stuart Station, Northern Territory, 12°34'S, 131°49'E.



Fig. 4. *Ctenotus essingtonii* (complex pattern form) in life. Black Point, Cobourg Peninsula, Northern Territory, 11°09'S, 132°10'E.

C. essingtonii species group (*C. brevipes*, *C. burbridgei*, *C. gagudju*, *C. hilli* and *C. quirinus* sp. nov.) in having combinations of broad dorsal zone of ground colour, vertebral stripe absent or confined to nape, prominent pale mid-lateral stripe and moderately callose subdigital lamellae. It differs from *C. burbridgei*, *C. gagudju* and *C. hilli* by having fewer mid-body scales rows (mode of 26 instead of 30 or more) and shorter hindlimbs (mean of 44.2% of snout-vent length, instead of 47.7% or more). Distinguished from *C. quirinus* sp. nov. by unpatterned or lightly spotted, instead of heavily blotched, upper lateral zone, fewer mid-body scales rows (mode 26 instead of 28, $p = 0.020$), longer hindlimbs (mean of 44.2% of snout-vent length, instead of 42.5%, $p = 0.001$), longer tail (mean of 225.8% of snout-vent length, instead of 213.3%, $p = 0.026$) and shorter snout (mean of 43.0% of head length, instead of 44.7%, $p = 0.012$).

Ctenotus essingtonii is most easily confused with *C. brevipes*, but is distinguished by being larger (mean SVL 53.1 instead of 48.0 mm, $p = 0.001$), having more fourth toe subdigital lamellae (mode 23 instead of 20, $P = 0.001$), longer head (mean: males 10.5 instead of 10.0 mm, $p = 0.001$; females 10.0 instead of 9.6 mm, $p = 0.001$) and more paravertebral scales (mean: males 64.2 instead of 58.4, $p = 0.001$; females 66.7 instead of 62.5, $p = 0.020$).

Distribution. The known distribution of *C. essingtonii* is in the far north and northwest of the Top End of the Northern Territory (Fig. 2). Within this distribution *C. essingtonii* occurs in the following bioregions (Environment Australia 2000): Arnhem Coast (ARC), Arnhem Plateau (ARP), Daly Basin (DAB), Darwin Coastal (DAC), Pine Creek (PCK) and Tiwi Cobourg (TIW).

Geographic variation. A significant pattern of latitudinal or longitudinal variation was identified between snout-vent length and both latitude ($r^2 = 0.095$, $n = 80$; $F_{1,78} = 8.231$; $p = 0.005$) and longitude ($r^2 = 0.052$, $n = 80$; $F_{1,78} = 4.291$; $p = 0.041$). Snout-vent length was not subject to sexual dimorphism and the increases in length from north to south, and west to east, appeared to be evenly clinal.

Ecology and habitats. *Ctenotus essingtonii* is a locally common, diurnal, terrestrial species that prefers woodland habitats on sandy soils. Horner (1991) records use of small vertical burrows for shelter and that it forages in open spaces. NTM records note that the species has been taken from closed and open forest, woodland and open woodland, shrubland and grassland on various soil types and has been associated with a variety of dominant vegetation types, including *Eucalyptus* spp., *Pandanus spiralis*, *Melaleuca viridiflora*, *Gronophyllum ramsayi*, *Corymbia* sp., *Acacia* sp., *Grevillea* sp., *Callitris* sp., *Erythrophleum chlorostachys*, *Allosyncarpia ternata* and *Terminalia carpentaria*. Specimens have been taken among leaf litter, grass tussocks, rocks, beach debris, beach sand dunes, under old iron and from suburban gardens (Darwin).

Nomenclatural history. *Tiliqua essingtonii* was described by Gray (1842) from a specimen collected by the naturalist John Gilbert at Port Essington. Aside from Boulenger (1887) treating *essingtonii* as a variety of *taeniolatum* and the description of *C. essingtonii brevipes* by Storr (1981), nomenclatural changes have been limited to changes in generic position. In 1887 Boulenger referred many scincid taxa to *Himulia* Gray, a subgenus of *Lygosoma* Gray. Subsequently Smith (1937) and Mittleman (1952) treated *Himulia* as a synonym of *Sphenomorphus* Fitzinger. Thus for many years the taxon was known as *Lygosoma (Sphenomorphus) essingtonii* (see Worrell 1963). Storr (1964) erected the new genus *Ctenotus* for a distinctive group of *Sphenomorphus* characterised by the presence of ear lobules and body pattern of longitudinal stripes or rows of spots.

Etymology. Although not specifically stating so, Gray (1842) obviously named this species after the type locality, "Inhabits north coast of New Holland; Port Essington".

Ctenotus quirinus sp. nov.

(Figs 2, 5–8; Tables 1, 2))

Material examined. HOLOTYPE – Adult female, NTM R16145, Cadell River Crossing, Arnhem Land, Northern Territory, Australia, 12°16.77'S, 134°25.45'E (Figs 5, 6). Collected by P. Horner, 0930 hours, 13 July 1989. Open shrubland habitat, active on bare sandy areas amongst grass tussocks, 100 metres from river bank. PARATYPES (38 specimens) – NORTHERN TERRITORY: AMR13466-467, R19721, R20463, Groot Eylandt, 13°58'S, 136°26'E, June 1948; AM R135910, R135928, R135906, R135933-934, R135938-939, Groote Eylandt, 13°55'S, 136°26'E, 16–17 September 1991; AM R75514, Mann River, Arnhem Land, 12°31'S, 134°06'E, 26 September 1978; NTM R3393, Eleho Island, 12°01'S, 135°37'E, March 1977; NTM R5972, Goyder River crossing, Arnhem Land, 12°56'S, 135°02'E, 29 August 1978; NTM R11410-411, Katherine Gorge, 14°19'S, 132°28'E; NTM R13788, Donydji, Birrin Birrin, Arnhem Land, 12°53.39'S, 135°28.26'E, 23 August 1988; NTM R16112, Cadell River Crossing, Arnhem Land, 12°15'S, 134°26'E, 12 July 1989; NTM R16890, Kakadu National Park (Stage Three), 13°45'S, 132°25'E, 14 April 1989; NTM R17885-886, Maningrida, Arnhem Land, 12°03'S, 134°13'E, 15 May 1993; NTM R18775, Cadell River, Arnhem Land, 12°37.5'S, 134°19.7'E, 3 September 1997; NTM R20293, Cape Arnhem, Arnhem Land, 12°22'S, 136°57'E, 11 February 1994; NTM R20411-413, Cadell

Table 2. Characters expressing sexual dimorphism in *Ctenotus essingtonii* and *C. quirinus* sp. nov.

character	taxon	p	sex	mean (mm)	N	range	std.dev.
body length	<i>C. essingtonii</i>	0.001	m	29.4	47	26.7–31.1	1.13
			f	30.6	33	28.4–33.0	1.12
	<i>C. quirinus</i> sp. nov.	0.021	m	29.4	19	27.4–32.0	1.30
			f	30.4	20	28.2–32.1	1.14
forebody length	<i>C. essingtonii</i>	0.005	m	18.3	47	15.8–19.9	1.08
			f	17.5	33	15.3–19.0	0.87
	<i>C. quirinus</i> sp. nov.	0.006	m	18.2	19	16.6–19.2	0.73
			f	17.6	20	15.6–19.2	0.80
head length	<i>C. essingtonii</i>	0.001	m	10.5	47	9.9–11.0	0.26
			f	10.0	33	9.6–10.7	0.29
	<i>C. quirinus</i> sp. nov.	0.001	m	10.3	19	9.8–10.8	0.32
			f	9.9	20	9.4–10.8	0.29
head depth	<i>C. essingtonii</i>	0.001	m	5.5	47	4.8–6.0	0.27
			f	5.1	33	4.3–5.8	0.31
	<i>C. quirinus</i> sp. nov.	0.048	m	5.3	19	4.6–6.1	0.38
			f	5.1	20	4.2–6.0	0.40
No. of paravertebral scales	<i>C. essingtonii</i>	0.002	m	64.2	47	57–71	3.46
			f	66.7	33	61–76	3.50
	<i>C. quirinus</i> sp. nov.	0.001	m	63.6	19	56–69	4.04
			f	70.1	20	64–80	4.55

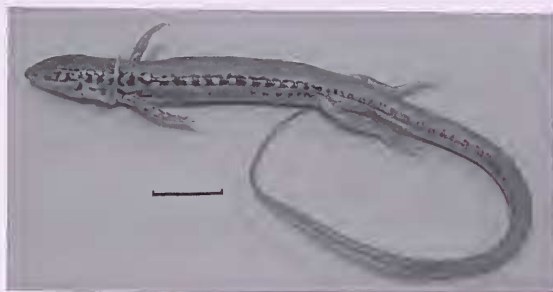


Fig. 5. Holotype of *Ctenotus quirinus* sp. nov., NTM R16145, Cadell River Crossing, Arnhem Land, Northern Territory, Australia, 12°17'S, 134°25'E.



Fig. 6. Head of holotype of *Ctenotus quirinus* sp. nov., NTM R16145, Cadell River Crossing, Arnhem Land, Northern Territory, Australia, 12°16.77'S, 134°25.45'E.

River, Arnhem Land, 12°08'S, 134°19'E, 7 May 1994; NTM R20549, Slesibeck Plateau, Kakadu National Park, 13°44'S, 132°44'E, 21 September 1988; NTM R20550-551, Upper Katherine River, 13°52'S, 132°47'E, 26 September 1988; NTM R20741, Kakadu National Park (Stage Three), 13°44'S, 132°43'E, 19 May 1990; NTM R23296, Elsey National Park, 14°54.64'S, 133°10.05'E, 6 December 1996; NTM R25546, Goyder River crossing, Central Arnhem Land, 12°59.57'S, 134°58.74'E, 28 July 1999; NTM R25608, Emu Springs, Goyder River, Central Arnhem Land, 12°56.12'S, 134°49.80'E, 21 September 1999; NTM R26140-142, Mann River, Arnhem Land Plateau, 13°25'S, 133°35'E, 6 September 2000; NTM R27403, Gimbat Creek, east of Mount Evelyn, Kakadu National Park, 13°36.44'S, 132°57.61'E, 23 February 2004; NTM R31902, Groote Eylandt, 13°52'S, 136°05'E, October 1969.

Diagnosis. A moderately small *Ctenotus* (SVL to 65 mm) distinguished from congeners by having three of four supraoculars in contact with frontal, two presuboculars, frontoparietals paired, laterally compressed toes with callose or smooth subdigital lamellae, prominent pale mid-lateral stripe, broad dorsal zone of ground colour, vertebral stripe absent or confined to nape, dark laterodorsal stripe obscure or absent, 28 midbody scale rows, lateral pattern of longitudinal zones or stripes, dark upper and lower lateral zones strongly spotted or blotched.

Description. Prefrontal scales usually broadly (44%) or narrowly separated (54%), occasionally in narrow contact (2%). Nasal scales usually narrowly separated (26%) by rostral and frontonasal scales (26%), occasionally broadly separated (8%) or in narrow (15%) or broad (10%) contact. Frontoparietal scales paired. Interparietal scale distinct. Loreal scales two, second usually larger than first. Upper and lower preocular scales present. Presubocular scale usually present (92%), occasionally absent (8%). Nuchal scales 4–8 (mean = 6.7, sd = 0.89), modally 7. Supraciliary scales 8–10 (mean = 9.0, sd = 0.53), modally 9, median four or five much smaller than first three and final scale in series. Ciliary scales 9–12 (mean = 9.8, sd = 0.78), modally 10. Supralabial scales 7–8 (mean = 7.1, sd = 0.39), modally 7, fifth usually under orbit (82%), occasionally sixth (18%). Infralabial scales 6–8 (mean = 6.9, sd = 0.35), modally 7. Ear lobules 2–4 (mean = 3.0, sd = 0.40), modally 3, uppermost usually largest (79%), occasionally mid-lobule largest (21%) (Table 1).

Midbody scale rows 25–28 (mean = 27.0, sd = 1.07), modally 28. Paravertebral scales 56–80 (mean = 66.9, sd = 5.37), modally 68. Subdigital lamellae usually moderately callose (77%) or occasionally smooth (23%), 11–14 below fourth finger (mean = 12.3, sd = 0.81) modally 12, 20–27 below fourth toe (mean = 22.7, sd = 1.46) modally 23. Supradigital scales above fourth finger 9–12 (mean = 10.0, sd = 0.84) modally 10, above fourth toe 16–22 (mean = 18.9, sd = 1.36) modally 19 (Table 1).

Snout-vent length to 64.9 mm (mean = 53.1 mm, sd = 4.83). *Percentages of snout-vent length:* Body length 51.4–62.0% (mean = 57.3%, sd = 2.58); tail length 170.8–239.4% (mean = 213.3%, sd = 16.55); forelimb length 21.5–27.6% (mean = 24.7%, sd = 1.47); hindlimb length 35.6–48.2% (mean = 42.5%, sd = 2.94); forebody length 30.1–37.4% (mean = 34.1%, sd = 1.82); head length 17.6–21.2% (mean = 19.2%, sd = 1.02). *Percentages of head length:* head depth 44.1–61.9% (mean = 51.9%, sd = 3.66); head width 50.6–66.3% (mean = 58.4%, sd = 3.18); snout length 24.4–50.6% (mean = 44.7%, sd = 4.01) (Table 1).

Colour and pattern (in spirit). A brownish or greyish *Ctenotus* with longitudinally aligned, complex body pattern dominated by immaculate, broad dorsal zone of ground colour, obscure dark laterodorsal and pale dorsolateral stripes and heavily blotched upper and lower lateral zones (Figs 7, 8). Intensity of body pigmentation and patterning is variable. Most specimens conform to the following description.

Dorsal ground colour dark olive brown to pale grey-brown. Immaculate, broad dorsal zone extends from head onto tail. Vertebral stripe absent. Blackish brown laterodorsal stripes often absent, but usually represented by a narrow, obscure, broken dark stripe on forebody from supraocular scales to past the forelimb. Narrow, creamish-white dorsolateral stripes usually present, about half as wide as underlying dorsolateral scales, extending from supraocular scales onto base of tail.

Lateral surface of body patterned with broad brown-black upper lateral zone, pale mid-lateral stripe and mottled lower lateral zone. Upper lateral zone extends from loreal region to hindlimb and is patterned by a single regular series of large pale spots or squarish blotches. Prominent white mid-lateral stripe, about one-third as wide as upper lateral zone, extends from supralabials, above forelimbs to hindlimb. Brown-grey lower lateral zone, about two thirds as wide as upper lateral zone, extends from behind auricular opening to hindlimb and is patterned with a more or less regular series of obscure pale blotches. Lower lateral zone coalesces into pale venter.

Head and tail concolorous with body. Limbs light brown dorsally, patterned with dark brown mottling and/or obscure dark brown stripes. Ventral surfaces immaculate white, underside of chin, limbs and tail creamish.

Sexual dimorphism. Sex ratio of specimens (20F:19M) was not significantly different from parity. Analysis of allometrically adjusted values detected significant sexual dimorphism in body, forebody and head lengths, head depth and number of paravertebral scales. Table 2 shows that females have a longer body and more paravertebral scales, but a shallower head and shorter forebody and head in comparison to males (means: body = 30.4 versus 29.4 mm, $p = 0.021$; paravertebral scales = 70.1 versus 63.6, $p = 0.001$; head depth = 5.1 versus 5.3 mm, $p = 0.048$; forebody length = 17.6 versus 18.2 mm, $p = 0.006$; head length = 9.9 versus 10.3 mm, $p = 0.001$).

Details of holotype. Adult female, NTM R16145 (Figures 5 and 6). Snout-vent length 48.1 mm; tail length 106.9 mm; body length 29.1 mm; forelimb length 11.9 mm; hindlimb length 21.1 mm; head width 5.7 mm; head depth 5.2 mm; snout length 4.3 mm; head length 9.5 mm; forelimb to snout length 16.0 mm; nasals narrowly separated; prefrontals broadly separated; supraoculars nine; ciliarys nine; supralabials seven; infralabials seven; nuchal scales seven; ear lobules four, second from top lobule largest in series; subdigital lamellae under fourth finger 14, under fourth toe 21; supradigital scales above fourth finger 10, above fourth toe 19; midbody scale rows 28; paravertebral scales 68.



Fig. 7. *Ctenotus quiriinus* sp. nov., in life. Goyder River crossing, Central Arnhem Land, Northern Territory, 13°00'S, 134°59'E.

Comparison with similar species. *Ctenotus quiriinus* sp. nov. is similar in appearance to those congeners having a plain dorsal surface (lacking dark vertebral stripe) and spotted dark upper lateral zone. Among these it differs from *C. allenii* Storr, 1974, *C. delli* Storr, 1974, *C. genuuula* Storr, 1974 and *C. mimetes* Storr, 1969 by midbody scale rows (mean of 28 instead of 26 or 30), by the dark upper lateral zone being patterned with a single series of large spots or blotches (instead of two or more series of small white spots) and by distribution (northern Northern Territory instead of southern Western Australia). In northern Australia *C. quiriinus* sp. nov. is distinguished from co-members of the *C. essingtonii* species group *C. burbidgei*, *C. hilli* and *C. gagudju* by having fewer mid-body scale rows (mean of 28, instead of 32 or 30) and shorter hindlimbs (mean of 42.5% of snout-vent length, instead of 47.7% or more). Further, it differs from *C. burbidgei* by having fewer supralabials (mean of seven instead of eight), from *C. hilli* by usually having fewer ear lobules (mean of three instead of five) and from *C. gagudju* by having frontoparietals paired instead of fused.

Ctenotus quiriinus sp. nov. is most like *C. brevipes* and *C. essingtonii* but is distinguished from *C. brevipes* by having more mid-body scale rows (mode of 28 instead of 24, $p = 0.001$), infralabial scales (mode of seven instead of six, $p = 0.006$), paravertebral scales (mean: males 63.6 instead of 58.4, $p = 0.001$; females 70.1 instead of 62.5, $p = 0.004$) and fourth toe subdigital lamellae (mean 22.7 instead of 19.9, $p = 0.001$), by being larger (mean SVL 53.1 instead of 48.0 mm, $p = 0.001$) and by having anterior ear lobules (instead of absent) and heavily blotched upper lateral zone (instead of unpatterned). Distinguished from *C. essingtonii* by more midbody scale rows (mode of 28 instead of 26, $p = 0.020$), shorter hindlimbs (mean of 42.5% of snout-vent length instead of 44.2%, $p = 0.001$) and tail (mean of 213.3% of snout-vent length, instead of 225.8%, $p = 0.026$), longer snout (mean of 44.7% of snout-vent length, instead of 43.0%, $p = 0.012$) and by heavily blotched upper lateral zone instead of plain or spotted.

Distribution. The known distribution of *C. quiriinus* sp. nov. is the far north and northeast of the Top End of the Northern Territory (Fig. 2). Within this distribution



Fig. 8. *Ctenotus quiriinus* sp. nov., in life. Maningrida, Arnhem Land, Northern Territory, 12°03'S, 134°13'E.

C. quirinus sp. nov. occurs in the following bioregions (Environment Australia 2000): Arnhem Coast (ARC), Arnhem Plateau (ARP), Central Arnhem (CA), Daly Basin (DAB), Pinc Creek (PCK) and Sturt Plateau (STU).

Sympatry. Records (NTM) document sympatry between *C. quirinus* sp. nov. and congeners at the following localities: Cape Arnhem (*C. inornatus*); Goyder River crossing (*C. vertebralis*); Mann River crossing (*C. vertebralis*); Donydji (*C. inornatus* and *C. robustus*); Gimbat (*C. coggeri* and *C. borealis*); Groote Eylandt (*C. inornatus* and *C. spaldingi*); Cadell River crossing (*C. astictus*, *C. coggeri* and *C. vertebralis*); Sleisbeck (*C. coggeri*, *C. vertebralis* and *C. borealis*); Katherine Gorge (*C. coggeri*, *C. inornatus*, *C. robustus*, *C. spaldingi* and *C. vertebralis*). Although not recorded as sympatric, the distribution of *C. quirinus* sp. nov. overlaps that of *C. essingtonii* in the mid-far north of Arnhem Land, where *C. quirinus* sp. nov. has been recorded in the vicinity of Maningrida and the Mann and Cadell Rivers and *C. essingtonii* from the Ramingining area (Fig. 2).

Geographic variation. A significant pattern of latitudinal or longitudinal variation was identified between hindlimb length and longitude ($r^2 = 0.203$, $n = 39$; $F_{1,37} = 9.434$; $p = 0.003$). Hindlimb length was not subject to sexual dimorphism and the increase in hindlimb length from western to eastern populations appeared to be evenly clinal.

Ecology and habitats. NTM records note *C. quirinus* sp. nov. as having been taken from open forest, open woodland and shrubland and commonly associated with sandy substrate. In these habitats it has been associated with a variety of dominant vegetation types, including *Eucalyptus kombolgieusis*, *E. miniata*, *E. tetradonta*, *Melaleuca viridiflora*, *Calytrix exstipulata*, *Triodia procera*, *Callitris* sp. and *Acacia* sp. Specimens have been recorded using shallow burrows and have been taken among leaf litter, grass tussocks, lateritic rocks, on bare sandy areas, fallen trees, sand dunes and hostel gardens.

Nomenclatural history. Material of this species has previously been referred to *C. essingtonii* (Cogger 2000; Cogger *et al.* 1983; Ehmann 1992; Wilson and Knowles 1988; Wilson and Swan 2003; Horner 1991; the latter publication includes a photograph as figure 36).

Etymology. Named for *Quirinus*, an important god of the Roman state.

DISCUSSION

Storr (1981) acknowledged significant morphological divergence between *C. brevipes* and *C. essingtonii*, but considered them subspecies on grounds of similarity in body form, pattern and colouration. The current study assessed both taxa by spatial data as well as morphological differences and recognised *C. brevipes* and *C. essingtonii* as 'reproductively isolated from each other' (biological

species) by having unique combinations of three or more significant morphological characters. Thus, although these taxa have allopatric distributions, morphological differentiation between them was assessed as comparable to similar morphological differentiation between *Ctenotus* taxa which have been identified as independent species in sympatry.

With the recognition of *C. brevipes* and *C. quirinus*, *Ctenotus* is now represented in the northern monsoonal tropics of Australia by 21 species (21% of described species), 17 of which include the Top End of the Northern Territory as all or part of their distribution. Many of these are restricted to small geographic areas (see distributions in Horner 1991 and Wilson and Swan 2003) and tend to show a strong fidelity to certain topography and habitat types.

Both *C. essingtonii* and *C. quirinus* have relatively restricted distributions which are largely allopatric, but have a narrow zone of overlap in the region between Maningrida and Ramingining in northern Arnhem Land (Fig. 2). Although not yet recorded in sympatry, the habitat preferences of *C. essingtonii* and *C. quirinus* are similar, both being found in (though not restricted to) woodlands on sandy soil types. Although geographically close, their distributions are largely separated by the dissected western Arnhem Land escarpment. This landform does contain scattered patches of woodland which, in the vicinity of the Katherine River at the southern end of the escarpment, are occupied by *C. quirinus*. It is postulated that *C. quirinus* and *C. essingtonii* are closely related taxa, which have speciated following the isolation of previously more contiguous populations in northern Australia.

ACKNOWLEDGMENTS

The author is grateful for the assistance of the following curators and collection managers from Australia and Britain, who generously loaned specimens and provided invaluable collection data, Patrick Couper of the Queensland Museum, Ross Sadlier of the Australian Museum, John Wombey of the Australian National Wildlife Collection and Colin McCarthy of the Natural History Museum, London. Helpful comments on the manuscript were provided by Dane Trembath. Permits for the collection of specimens in the Northern Territory were through the courtesy of the Parks and Wildlife Commission of the Northern Territory.

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Accepted 24 October 2007